

REMARKS

Reconsideration and allowance of the subject application are respectfully requested.

Claims 1-5, 7, 8, 10-17, 19, 20, and 22-26 are pending in the application.

The subject matter of dependent claim 9 has been incorporated into base claim 1. The subject matter of dependent claim 21 has been incorporated into base claim 13. No new matter has been added by these amendments.

The rejection of claims 1-26 under 35 U.S.C. § 102(b), or, in the alternative, under 35 U.S.C. § 103, over Balatoni, Asai, Torii, or Podola is respectfully traversed. The claimed invention is not anticipated, taught or suggested by any of the cited prior art references.

As set forth at page 2 of the present specification, combinations of PVC, thermoplastic polyurethanes and plasticizers are known from Japanese Unexamined Patent Publications Nos. Sho 55-116747, Sho 52-108454, Sho 53-18656 and Sho 60-92345. These known compositions are not satisfactory with respect to having both low temperature impact resistance and high temperature modulus. The claimed invention provides a composition which surprisingly overcomes the above deficiencies of conventional compositions.

The claimed invention relates to a soft vinyl chloride resin composition which comprises a vinyl chloride resin, a thermoplastic polyurethane (TPU) and an alkyl phthalic ester of a defined formula which has a linear chain ratio of an ester group (normal portion) of 80% or more. The thermoplastic polyurethane and the phthalic ester are, respectively, present in amounts of 20 to 150 parts by weight and 60 to 150 parts by weight based on 100 parts by weight of the vinyl chloride resin. The claimed invention also relates to molded articles comprising the above-defined composition.

The composition of the claimed invention has improved low temperature flexibility/high temperature modulus. This feature is illustrated by Figure 1 as follows.

Figure 1 illustrates the relationship between the $\tan \delta$ peak temperature and the tensional modulus. The low temperature characteristic expressed in terms of the $\tan \delta$ peak temperature and the tensional modulus at 100°C are known by one of ordinary skill in the art to be characteristics which are contrary to each other. It has been generally accepted that where importance is placed on the heat resistance in soft polyvinyl chloride compositions, higher phthalic acid esters such as DIDP are appropriate. In this case, the $\tan \delta$ peak temperature is shifted to a higher temperature side, such as comparative example C9 in Figure 1.

On the other hand, when importance is placed on the cold resistance, it is accepted that use of aliphatic acid esters such as adipates, cebacates and the like is favorable. In this case, the tensional modulus at 100°C is significantly lowered with a loss of practical strength and also with a considerable loss of durability.

When the combination of PVC/TPU/normal phthalic acid ester according to the claimed invention is used, surprisingly the low temperature characteristic/high temperature characteristics are well balanced which is not attained by prior art counterparts. This effect has been found for the first time, according to the claimed invention, and is illustrated in Figure 1.

Further, if the normal phthalic acid ester present in the improved composition of the claimed invention has 7 to 9 carbon atoms, as recited in dependent claim 8, the composition is resistant to light and bleeding of the plasticizer is suppressed.

Asai teaches a method for preventing bleeding of plasticizers on the surface of shaped articles of plasticized polyvinyl chloride resins.

Asai teaches that a plasticized polyvinyl chloride resin is blended with a urethane elastomer prior to fabrication into a shaped article, shaping the mixture and finally subjecting the shaped article to treatment with low temperature plasma gas.

Column 2, lines 49 to 53 of Asai disclose that the urethane elastomer is effective in accelerating crosslink formation on the surface layer of the shaped articles during the treatment with low temperature plasma. Moreover, at column 2, lines 61 to 64 of Asai, the urethane elastomer is crosslinked to give rubbery elasticity.

In contrast, the thermoplastic polyurethane according to the claimed invention is not crosslinked and provides an improved low temperature resistance and heat resistance, as stated at page 7, lines 32 to 36 of the present specification.

The disadvantages of thermosetting polyurethanes are disclosed in Comparative Example 6 of the present application at page 19, line 32 and page 20, lines 1-31.

The plasticizers used in Asai are set out at column 3, and include a diversity of compounds such as phthalic esters, aliphatic dibasic carboxylic esters, aliphatic monobasic carboxylic esters, phosphates and epoxidized oils. The phthalic acid esters mentioned in Asai include dioctyl phthalate (DOP), dibutyl phthalate and the like. However, one of ordinary skill in the art would understand the DOP in Asai to be conventional dioctyl phthalate which has a linear chain ratio of 0 as indicated in Table 1 of the present specification at page 13. The use of such DOP is illustrated as C1 for comparison in the present specification. Asai does not teach or suggest using

phthalic esters having a linear chain ratio of 80% or more. Furthermore, Asai discloses no preference for using phthalic esters instead of the diversity of plasticizer compounds disclosed.

Further, Asai does not teach or suggest the improved cold and heat resistance according to the claimed invention.

Balatoni discloses blends of thermoplastic polyurethane elastomer, polyvinyl chloride resin and chlorinated polyethylene. The blends are disclosed as having good processing characteristics. At column 2, lines 45 to 57 of Balatoni, a number of PVC plasticizers are mentioned, including monomeric or polymeric esters of phthalic acid. However, no mention is made of the specific linear chain ratio recited in the claimed invention nor of the numbers of carbon atoms in the alkyl moieties. The composition of TPU/PVC/chlorinated PE is disclosed in Balatoni as being suitable for calendering and film formation.

The composition of Balatoni has a Shore hardness which is not lower than 90 (corresponding to JIS-A hardness of not lower than 90) and is of the hard type.

In contrast, the vinyl chloride resin composition of the claimed invention is of the soft composition type having a large amount of alkyl phthalic ester plasticizer and a JIS-A hardness of approximately 70.

Balatoni teaches a thermoplastic polyurethane elastomer composition rather than polyvinyl chloride compositions, to which polyvinyl chloride and chlorinated polyethylene are added in order to improve processability of the polyurethane elastomer.

If chlorinated polyethylene is added to the composition of the claimed invention, as taught by Balatoni, there would be no improvement in the cold and heat resistances of the vinyl chloride resin composition.

Torii discloses a process for preparing a thermosettable polyurethane product. The process comprises blending a compound having two or more terminal isocyanate groups to a thermoplastic resin, which is inert to an isocyanate group, to prepare an isocyanate compound batch, and further blending the isocyanate compound batch to a thermoplastic polyurethane resin. The thermoplastic resin includes polyvinyl chloride. The blended composition is thermosettable in nature, which is completely different from the soft vinyl chloride resin composition according to the claimed invention. Furthermore, the soft vinyl chloride resin composition according to the claimed invention is thermoplastic, not thermosettable.

The thermosettable composition of Torii is molded such as by extrusion, injection or the like molding techniques to obtain a thermoset article. The urethane elastomer is improved in solvent resistance.

Torii does not teach an improvement of vinyl chloride resin by incorporation of a thermoplastic polyurethane and an alkyl phthalic ester. No mention is made of plasticizers and also of the combination of vinyl chloride resin, thermoplastic polyurethane and alkyl phthalic ester.

Podola relates to moisture-hardening joint sealing compositions. The composition comprises polyurethane prepolymers, swettable polymer powders, plasticizers and stabilizers. Polyvinyl chloride is used as the swettable polymer powder, in which case phthalic acid ester may be used in combination. Polyurethane prepolymers must be hardened by the action of moisture, and polyvinyl chloride is added in the form of a powder.

The polyurethane used in the composition of the claimed invention is thermoplastic and cannot be hardened by means of moisture. Thus, the claimed polyurethanes are completely different from those disclosed in Podola. Moreover, polyvinyl chloride is not used in the form of powder as a thixotropicizing agent in the claimed invention.

The sealing composition of Podola has improved stability during storage.

The composition of the claimed invention is not anticipated or obvious from the teachings of the cited references. The claimed invention recites a completely different

type of polyurethane and a different application of vinyl chloride resin from the theoretical composition of the cited references.

Accordingly, withdrawal of the Section 102 and Section 103 rejections is respectfully requested.

The rejection of claims 1-26 under 35 U.S.C. § 103 over Balatoni or Asai or Torii or Podola each in view of Downey or Ohachi or Geissler is respectfully traversed. The claimed invention is not taught or suggested by the theoretical combination of the cited prior art for the reasons stated above and for the following reasons.

Downey relates to a plasticized polyurethane gel system comprising the reaction product of an isocyanate compound and a polyol in the presence of a plasticizer compound. The plasticizers include diundecyl phthalate and diisodecy phthalate, which are not the phthalates used in the claimed invention.

This gel system is provided as a grease-compatible, non-spewing material for use in reclaiming, encapsulating or sealing electrical cables or devices. Since, as discussed hereinabove, none of the primary references teach a soft vinyl chloride resin composition which is adapted for automobile components such as covers of air bag devices, steering wheel pads, shift lever boots and the like, and since there is no motivation for combining vinyl chloride resins with the

plasticized polyurethane gel system of Downey, the claimed invention is not taught or suggested by Downey in combination with the primary references.

Moreover, the use of normal phthalic esters having a defined linear chain ration is, by no means, taught in Podola or any of the primary references.

Geissler relates to blood compatible, chlorine-free polymers such as a flexible, non-toxic, sterilizable polyester plastic formulation. The applicants submit that Geissler does not teach dialkyl phthalate within the claimed invention as plasticizers for either PVC or polyurethane.

The formulation of Geissler contains, dispersed therein, preferably from 5 to 70 percent by weight of a blood-extractable material comprising a fatty ester containing at least two ester linkages comprising fatty hydrocarbon groups of four to 12 carbon atoms. Dialkylphthalates in which each alkyl radical contains from 7 to 10 carbon atoms and having a branched chain, is mentioned as one preferred category of material. The dialkylphthalates having a branched chain in the alkyl radical are different from normal phthalic esters recited in the claimed invention.

Polyurethanes and copolymers with other polymer materials are disclosed as chlorine-free polymers for dispersing the phthalates.

Geissler fails to teach the use of polyvinyl chloride in combination with polyurethanes plasticized with phthalates. The types of phthalate plasticizers of the claimed invention and Geissler are different from each other. It is not understood at all from the teaching of Geissler why it is necessary to combine plasticized polyurethane with polyvinyl chloride. More particularly, Geissler fails to teach an improvement of the low temperature or cold resistance of a vinyl chloride resin composition which is incorporated with PTU and a specific type of normal phthalate. Moreover, the claimed invention has a completely different purpose from Geissler and Geissler is in a completely different art field.

Ohachi relates to a medical instrument which is a shaped article of a resin composition. The composition comprises a vinyl chloride-type resin, a di-n-alkyl ester of phthalic acid, and a stabilizer.

The vinyl chloride-type resin includes vinyl chloride or vinylidene chloride homopolymer, or a copolymer of vinyl chloride with another monomer. Examples of the di-n-alkyl phosphates include di-n-nonyl phthalate, di-n-decyl phthalate, di-n-undecyl phthalate and the like. Examples of the stabilizer include epoxidized compounds, metallic soaps, mixtures thereof. The composition of Ohachi is intended to suppress plasticizers

from exudation and impart good gas permeability because the instrument is intended to be used in contact with blood.

There is no motivation to add polyurethane resins to the vinyl chloride-type composition of Ohachi. Ohachi and the cited primary references are not intended to improve cold and heat resistances of vinyl chloride resin compositions.

Furthermore, how to deal with the epoxy or metallic soap stabilizer, which is essential in Ohachi, is not known when combined with the primary references.

Thus, the claimed invention is not taught or suggested by Ohachi taken alone or in combination with each of the primary references.

Accordingly, removal of the Section 103 rejection is respectfully requested.

The rejection of claims 1-26 under 35 U.S.C. § 103 of Pusineri in view of either Ohachi or Geissler is respectfully traversed. The claimed invention is not taught or suggested by the theoretical combination of cited references for the reasons stated above and for the following reasons.

Pusineri teaches a polymer composition comprising a mixture of vinyl chloride polymer and polyetherurethane with tertiary amine and/or ammonium groups. The polyetherurethanes of Pusineri which have essentially tertiary amine and/or ammonium

groups are different from the polyurethanes of the claimed invention.

The combination of PVC/TPU in Pusineri is intended to prepare a plasticizer-free composition. Pusineri at column 4, lines 19 to 21 discloses that the materials or shaped articles exhibit the advantage of avoiding the use of plasticizers which can exude or leach in contact with biological or physiological liquids. This leads to the conclusion that there is of no motivation to combine the composition of Pusineri with plasticizers noted in Geissler or Ohachi.

Thus, the claimed invention is not taught or suggested by Pusineri taken alone or even in combination with Geissler or Ohachi.

The soft vinyl chloride resin composition of the claimed invention which is a combination of PVC, PTU and a specific type of phthalate and which has improved cold and heat resistance of the PVC and PTU mixture is not taught or suggested by any of the cited references taken alone or in combination.

Accordingly, withdrawal of the Section 103 rejection is respectfully requested.

In view of the above, reconsideration and allowance of the subject application are respectfully requested.

Respectfully submitted,

CUSHMAN, DARBY & CUSHMAN

By *G. Lloyd Knight* 18681
G. Lloyd Knight
Reg. No. 17,698
Tel. No. (202) 861-3090
Fax No. (202) 822-0944

GLK/JSM:1km
1100 New York Avenue, N.W.
Ninth Floor
Washington, D.C. 20005-3918
(202) 861-3000